

DATE: October 25, 2017
TO: Cecelia Hyunh, Portland Water Bureau
FROM: Sarah Reich, Joel Ainsworth, Bob Whelan
SUBJECT: ECONOMIC EFFECTS OF A 2-DAY AND 2-WEEK BOIL WATER NOTICE

Introduction and Summary

The City of Portland Water Bureau (PWB) contracted with ECONorthwest to study the economic effect arising from a city-wide boiled water notice (BWN) under two scenarios: a BWN lasting for two days and up to two weeks.

In 2010, PWB asked ECONorthwest to analyze the economic effects that arose from a two-day BWN issued in Portland during November of 2009. The BWN affected customers in nine zip codes on the City's west side. This analysis applies a similar methodology to calculate the economic effects of a hypothetical BWN that would last for two days and affect the entire city.

While City residents and businesses have experience with BWNs that are limited to a few days, a BWN lasting two weeks is unprecedented in the City of Portland, and has occurred infrequently in the U.S. Rather than scaling the economic effects from the two-day BWN to two weeks, we conducted additional research focused on identifying whether a BWN lasting for a week or more would elicit different behavioral responses from households and business owners.

Our research for this analysis included a detailed literature review, key-informant interviews, and an updated survey of food-service businesses. This memo presents the results of our analysis of city-wide economic effects under a two-day and two-week BWN. We focused our analysis on the economic effects in the City of Portland itself, though economic effects are likely to occur outside of the City, across a broader region, as well.¹

A BWN of any duration would impose costs on households and businesses. Some of these costs are easier to measure than others, and some costs would translate into economic effects on business activity (e.g., changes in output and wages) that we are able to measure using the IMPLAN model. Based on key-informant interviews, survey data, and a review of the literature, we quantified costs to **households** and the food-service sector (e.g., **eating and drinking establishments**) for a BWN lasting for two days and two weeks. Using the IMPLAN model, we translated the economic costs incurred by the food-service sector into changes in economic activity. We investigated economic effects to other sectors, including the accommodation sector (e.g., **tourism**), the retail sector (e.g., **grocery stores**), and the manufacturing sector (e.g., **food processors**), and describe these potential effects qualitatively. Table 1 presents a summary of our findings.

¹ For example, we do not include the potential economic effects arising from BWNs issued by the PWB's wholesale customers.

Table 1. Summary of Economic Effects of a BWN in the City of Portland, by Sector of the Economy¹

| Sector | 2-day Notice | 2-week Notice |
|---|---|--|
| Households | \$13 million Includes costs related to direct water consumption (bottled water, disinfection, and replacing filters), cooking and eating (disposable dishware, eating out more or less), work and school schedule disruptions (changes in work schedules and childcare requirements), and travel costs (travel for supplies and cost for lodging when staying outside the area). | \$91 million |
| Food-Service Sector | Lost Output: \$3.6 Million Lost Wages: \$1.4 Million Includes costs related to reduced business operating hours and closure. Additional economic effects could occur through increases in other costs. | Lost Output: \$39 Million Lost Wages: \$14 Million Includes costs related to business closure. Additional economic effects likely would occur through reduced operating hours and other costs. |
| Accommodation Sector (Hotels and | Increased cost of bottled water and additional labor. Overall effect likely small. | Increased cost of bottled water and additional labor. Potentially large and lasting negative effect on revenues from lost bookings and rate cuts to bring tourists back. |
| Retail Sector (Grocery Stores) | Increased labor costs and lost revenue from discarded food; potential revenue increase from increased sales of bottled beverages and prepared food. Net effect ambiguous. | |
| Manufacturing Sector (Food Processors) | Difficult to generalize across producers: a few businesses may experience large costs that may result in temporary closure and loss of economic activity. Others that do not rely on City water, have secondary treatment systems, or that already boil water (such as breweries) may incur limited to no costs, even in the two-week scenario. | |

Source: ECONorthwest IMPLAN Analysis, with data from IMPLAN and the Food Service Sector Survey

Note: ¹ The results for Households and the Food-Service Sector report different economic measures of loss. Thus, they are not additive.

The costs and reductions in economic activity presented in Table 1 represent our estimates based on the best data currently available. Because BWNs lasting for two-weeks are unprecedented in the City of Portland (and very rare elsewhere), significant uncertainty underlies our findings for the two-week scenario. Our results may overestimate economic effects under each scenario because:

- Businesses may have a greater ability to adapt than they anticipate.
- Shifts in consumer and business behavior during and after the BWN may offset some of the estimated losses.

Our analysis may **underestimate** the actual economic effects because:

- We include only one category of effect in our IMPLAN analysis, though we identified other areas where economic effects may occur but are too speculative to quantify given available data.
- We did not attempt to model shifts in household spending that transfer outside the impact area. These shifts would be limited if the BWN expands to wholesale customers.
- We were unable to quantify economic effects for other business sectors, especially grocery stores and tourism-dependent businesses, which may experience revenue losses that they would not be able to recover after the BWN ends.

Methodology

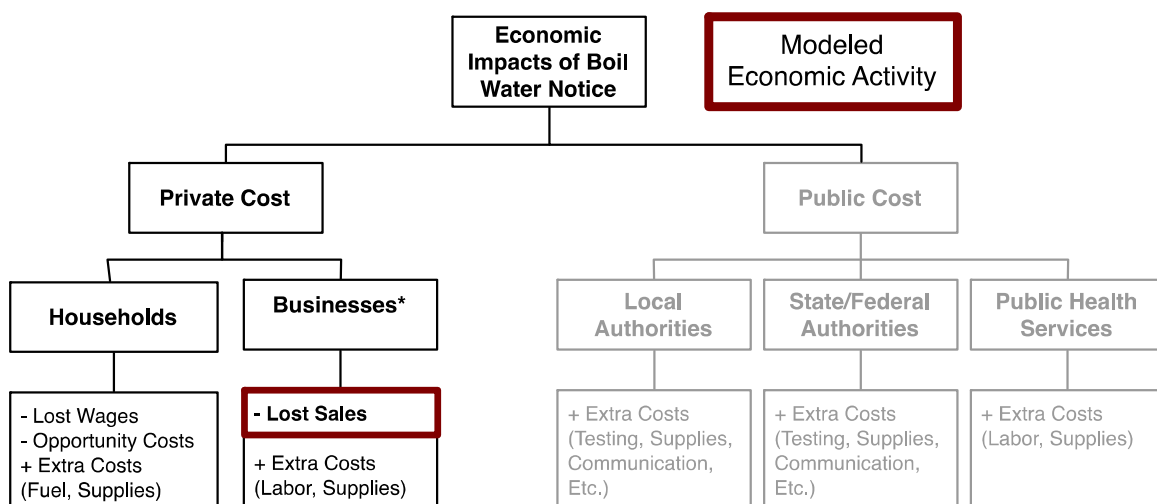
This section describes our methodology and assumptions for the analysis:

- We describe a **conceptual framework** for economic costs and economic effects, identifying the sectors and costs included in our research and analysis.
- We describe the **data collection** methods.
- We identify the **impact area**.
- We describe the **inputs for the IMPLAN model**.

Conceptual Framework for Economic Effects

A small but growing body of literature describes the economic effects of water contamination events that require a BWN (a summary of this literature is included in Appendix A to this memo). When a BWN occurs, public entities, households, and businesses suddenly are faced with conditions that motivate shifts in behavior and spending, to avoid potentially greater costs associated with getting sick or making customers sick.² Figure 1 illustrates a conceptual framework for these costs, drawn from the literature.

Figure 1. Conceptual Framework of Costs Arising from a BWN



Source: Adapted from Chyzheuskaya et al. 2017

*Restaurants, Hospitality, Grocery, Food/Beverage Production, Medical

The literature groups the potential effects into public and private costs. Public costs include those to local, state, and federal government, including public health authorities. Private costs

² The degree to which households and businesses actually change their behavior and shift their spending patterns relates to their perception of the risk and cost of getting sick. If they perceive the risk or overall cost as low, they may be less likely to respond. Businesses are motivated by legal and economic consequences if customers get sick, so are more likely to comply with the provisions of a BWN regardless of perceived risk.

are divided into household costs and business costs.³ This study focuses on private costs, which is why the public side is faded in the figure. We briefly describe the public costs and reasons for omitting them in more detail below.

Consistent with the literature, we make a distinction between *costs* and *economic effects*.

- **Costs** include additional spending on goods that reduce consumers' utility, time spent in ways that make people less satisfied than what they would otherwise be doing, and lost productivity for private and public entities.
- **Economic effects** represent changes in business revenue, wages, jobs, and tax revenues resulting from an event, such as the BWN. Economic effects may be positive or negative, and typically result from a change in prices or spending patterns, changes in business productivity, or changes in business investment in a particular area.

A BWN could create *economic effects* by generating changes in consumer behavior that may trigger changes in spending patterns within the study area. A BWN also could directly reduce business revenue and productivity. For reasons we describe below, we only model economic effects for a subset of the potential costs identified in Figure 1.

Public Costs

Public costs include extra time and expense to address the technical and regulatory steps that are required during and following a contamination event triggering a BWN. While most of these costs may fall to the PWB itself, other government entities that may incur costs include the Oregon Health Authority, Oregon Department of Environmental Quality, and the U.S. Environmental Protection Agency. The public health system may also incur costs associated with monitoring for illness and addressing public concerns regarding potential illness, even if documented illness does not occur.

Should contamination result in major illness, costs in all categories, but especially for the public health system, would be more substantial. Our study does not quantify these public costs, as it was not identified in our scope of work and likely would require a substantial level of effort to identify and measure. The degree to which they would result in economic effects is difficult to determine: to the extent government budgets are held constant regardless of event, these costs may represent shifts from one type of spending to another, without resulting a net change in economic activity within the study area.

Private Costs

Private costs are grouped into two categories: costs for households and costs for businesses. When a BWN occurs, households may experience the economic costs in several ways:

³ See, for example, Chyzheuskaya et al. 2017. "Economic Assessment of Waterborne Outbreak of Cryptosporidiosis." *Emerging Infectious Diseases*. 23(10): 1650-1656.

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- Direct expenses to purchase boiled water, use additional energy to boil water, and purchase disposable tableware, prepared food, etc. This spending may or may not result in a net increase in spending: it may simply represent a shift from normal grocery items to other grocery items, for example.
 - Lost wages if employed at a business that closes in response to a BWN.
 - Opportunity cost of time spent boiling water, disinfecting, or shopping for supplies.

Not all businesses would be affected by a BWN. Those sectors most likely to experience costs are the food service sector (full service restaurants, limited service restaurants, drinking establishments, and mobile service), the accommodation sector (hotels, motels, and B&Bs), grocery stores within the retail sector, food processors within the manufacturing sector (e.g., breweries, bottlers, food manufacturers), and the health care sector. Our research in 2010 indicated that restaurants would experience the overwhelming majority of costs, so our research in this study focused on this sector. The restaurant sector may experience the following economic costs:

- Direct supply expenses to purchase bottled water, use additional energy to boil water, and purchase disposable tableware, prepared foods, etc., and to discard contaminated.
- Direct labor expenses to decontaminate equipment, boil water, and address customer concerns.
- Lost revenue if increased direct expenses and fewer customers induce a business owner to close or curtail hours or menu offerings.

Other sectors experienced similar types of supply costs, though they were more limited in scale and scope. A two-week BWN might affect some sectors differently than others: for example, the accommodation sector may experience a minor increase in costs (e.g., for providing additional bottled water to guests) for a two-day BWN, but a BWN lasting two weeks may result in reservation cancellations, leading to lost revenue as well. The analysis below reports the costs and likely economic effects associated with each BWN notice on four private sectors: households, food service businesses, accommodation businesses, and other businesses.

Study Area

The assumption for the analysis under both scenarios is that the BWN would be issued for all PWB customers.⁴ Thus, the study area is the PWB service area. However, the IMPLAN model used to estimate economic effects is built on zip codes. We identified the zip codes that

⁴ In our 2010 analysis, the BWN was issued because of a water-quality issue at PWB's Reservoir 3. Because the potential contamination was detected at the distribution reservoir, the BWN only affected customers who received water from Reservoir 3. We mapped this service area to a set of zip codes on Portland's west side, which was the study area for the previous analysis. This analysis assumes either the contamination is detected throughout the entire PWB service area or cannot be traced to a specific part of the system, potentially arising from contaminated source water.

approximate the PWB service area to represent the study area for this analysis.⁵ Figure 2 shows both the PWB service area and the zip codes used to approximate the service area. The overlap is not perfect; some zip codes extend beyond the PWB service area, so the study area used for the analysis is slightly larger than the actual area that the BWN would affect.

Figure 2. Portland Water Bureau Service Area and Portland Zip Codes Included in Analysis



Source: ECONorthwest using base map from the City of Portland and GIS zip code data.

The economic model of the study area was constructed using 2015 IMPLAN data (the most recent year available). Based on this data, the study area encompasses 291 square miles, and includes 718,848 persons (301,580 households).

Economic data for the study area are shown, by aggregate industry sector, in Table 2. The first two columns show how Gross Regional Product (GRP) is distributed across industry sectors. GRP is a measure of the value added during the production of goods and services and is the sum of wages, business income, other income, and indirect business taxes. By this measure, the largest industry sectors are real estate (14.4 percent of total GRP), Government (13.9 percent), and professional and technical services (11.7 percent). Food services accounts for 2.5 percent of total GRP in the study area.

⁵ Zip codes included in the study area: 97266, 97239, 97236, 97233, 97232, 97231, 97230, 97229, 97227, 97221, 97220, 97219, 97218, 97217, 97216, 97215, 97214, 97213, 97212, 97211, 97210, 97209, 97208, 97206, 97205, 97204, 97203, 97202, 97201

Table 2. Baseline Economic Data for Study Area, by Aggregate Industry Sector (2014 dollars)

| Industry Sector | Gross Regional Product | | Employment | |
|--|------------------------|------------------|----------------|------------------|
| | \$ Millions | Percent of Total | Jobs | Percent of Total |
| Real estate and rental and leasing | 7,550.3 | 14.4% | 25,663 | 4.5% |
| Government and unclassified sectors | 7,276.0 | 13.9% | 79,369 | 13.8% |
| Professional and technical services | 6,138.6 | 11.7% | 62,217 | 10.8% |
| Health care and social assistance | 4,093.4 | 7.8% | 63,058 | 10.9% |
| Manufacturing | 3,605.7 | 6.9% | 35,716 | 6.2% |
| Wholesale trade | 3,543.7 | 6.8% | 23,204 | 4.0% |
| Finance and insurance | 3,357.8 | 6.4% | 27,532 | 4.8% |
| Management of companies | 2,507.7 | 4.8% | 19,520 | 3.4% |
| Construction | 2,130.4 | 4.1% | 24,651 | 4.3% |
| Transportation and warehousing | 2,124.9 | 4.1% | 20,545 | 3.6% |
| Retail trade | 2,058.5 | 3.9% | 43,441 | 7.5% |
| Information services | 2,006.5 | 3.8% | 14,491 | 2.5% |
| Administrative and waste services | 1,409.8 | 2.7% | 29,809 | 5.2% |
| Food services | 1,290.6 | 2.5% | 44,901 | 7.8% |
| Utilities | 934.7 | 1.8% | 1,327 | 0.2% |
| Other services | 848.2 | 1.6% | 19,760 | 3.4% |
| Educational services | 638.6 | 1.2% | 17,112 | 3.0% |
| Arts, entertainment, and recreation | 485.4 | 0.9% | 18,038 | 3.1% |
| Accommodation | 243.3 | 0.5% | 4,639 | 0.8% |
| Agriculture, forestry, fishing and hunting | 136.9 | 0.3% | 998 | 0.2% |
| Mining | 31.8 | 0.1% | 243 | 0.0% |
| Total | 52,413 | 100.0% | 576,234 | 100.0% |

Source: ECONorthwest using IMPLAN data (2014 Dollars)

Notes: Rows in bold indicate those a BWN would most likely affect.

The last two columns in Table 2 show how employment varies across industry sectors in the study area. Government is the top industry in terms of employment, accounting for almost 14 percent of total jobs in the study area. Health care and professional services round out the top three. Food services accounts for proportionally more employment than GRP: it ranks as the fourth most important sector in the study area in terms of employment, with 7.8 percent of total.

Much of the economic activity in the study area is attributed to businesses with production processes that would be largely unaffected by the BWN. As shown in Table 2, the industry sectors with operations and sales that would likely be affected by the BWN represent a relatively small percentage of overall employment in the study area. These sectors include food services (7.8 percent of total employment) and accommodations (less than 1 percent of total employment).

Although the study quantifies the economic effects of a citywide water boil notice, the study does not attempt to quantify how wholesale customers would be affected. This was due to how

the geography was defined for the project. Our study was focused on the cost of the BWN to the City of Portland and their retail customers. Wholesale customers would also likely experience negative effects from a BWN, however, were outside the scope for this analysis.

Data Collection

The primary inputs for this analysis were gathered through research and survey efforts by ECONorthwest, including a literature review, internet survey, and key-informant interviews.

Literature Review

ECONorthwest compiled research from a variety of databases including the American Economic Association's EconLit, which contains over 1.3 million publications from peer-reviewed journals and books, JSTOR, a database of more than 10 million academic journal articles, LexisNexis, which provides access to thousands of local news stories from around the world, and the ScienceDirect and ResearchGate databases.

We focused on research describing costs to households and businesses associated with BWNs, and the economic effects of BWNs and water service disruptions arising from responses by businesses. ECONorthwest also researched news reports of BWNs and water service disruptions lasting week or longer in duration. Reports that discuss longer BWN events were limited, and formal research that attempted to quantify economic effects of events were scarce.

This literature review informed the types and magnitudes of costs experienced by households and businesses reported below. Our conclusions from the literature review led us to focus our primary research and data collection efforts on industries most likely to experience economic effects from a two-day or two-week BWN. It also informed our discussion of behavioral responses to a two-day and two-week BWN, and how those responses may affect the direction and magnitude of economic effects from the events.

Survey of Eating and Drinking Establishments

We conducted a survey following the methods used in the 2010 study. We initiated both an online and telephone survey of eating and drinking establishments in the study area, using the same survey instrument (included in Appendix A). The survey included 8 questions, grouped into two parts. The first part of the survey asked how restaurant owners/managers actually responded to the BWN issued in May 2014, which lasted approximately 24 hours. The second part of the survey asked how their responses would be different if the BWN lasted for a week or more. Compared to the 2010 survey, we designed this survey to focus on qualitative information about the business' response to the BWN, rather than quantitative effect estimates, for several reasons:

- The time between the 2014 event and the survey is too long for respondents to remember precise financial information.
- Inquiring about specific financial information that business owners might perceive as sensitive or confidential may reduce response rates, or yield unreliable results.

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- In the case of the extended BWN, business owners would have no direct experience to base responses on, leading to potentially wide ranging and baseless responses.

Telephone Survey Details

Data Source: Oregon Employment Department Database.

Number of Establishments: This database consists of approximately 3,000 records of businesses located within the study area registered as one of five categories (full service restaurants, limited-service restaurants, drinking place [alcoholic beverages], snack and nonalcoholic beverage bar (e.g., coffee shop), and mobile food service. We drew 10 percent sample of these businesses, totaling 294 businesses.

Survey Protocol: We developed a survey script, which the PWB reviewed and approved. We began dialing on July 28, 2017. The survey taker asked for the manager or owner of the establishment, and once we found the appropriate person, we asked if they would complete the survey by phone or asked them for an email address, to which we sent an invitation to take the survey online. All contacted elected to provide an email.

Response: Reaching food-service sector contacts by phone proved very difficult. Out of 100 initial phone calls, we were successful at initiating the survey just a few times. Of those, all respondents asked to complete the survey online. Only two of these respondents completed the survey online. Due to poor response and completion, we abandoned the telephone survey in favor of the online method, which provided a higher response rate.

Online Survey Details

Data Source: Multnomah County Health Department Database.

Number of Establishments: This database consists of approximately 3,500 records of eating and drinking establishments, including mobile food service establishments, registered with the County. We filtered the list for those in the study area where the record included an email address, resulting in 1,140 establishments.

Survey Protocol: We adapted the survey script to a format in Survey Monkey that included all of the same questions. The PWB reviewed and approved this survey instrument. On August 2, 2017, we sent an introductory email through Survey Monkey to all establishments. After receiving a very limited response (37 completed surveys, or about 3 percent) during the first week, we asked PWB staff to send a follow-up email. This email was sent August 23, 2017. We held the survey open for 2 weeks after the second email was sent, though no response were logged after August 28, 2017.

Response: We received 79 completed surveys. 37 were logged after the first email, and an additional 42 were logged in response to the second email. This represents an overall response rate of approximately 7 percent, which is low by historical standards, but not an unusually low response rate for modern online surveys of broad public audiences with little to personally gain

from participating.⁶ Other researchers have reported similar challenges to reaching food service establishments.⁷

We tabulated the results from the survey and present the findings below under Survey Results. Many of the respondents provided detailed and insightful open-ended responses explaining how the BWN would affect their business. We expect the PWB will find useful insights in this data set, independent from the economic analysis. The complete survey responses are included as Appendix B.

Key-Informant Interviews

We conducted interviews with two categories of key-informants to collect additional information: representatives of industries other than eating and drinking establishments in the study area, and representatives knowledgeable about business response to extended BWN.

Industry Representatives

The PWB provided contact information for business customers from two sources:

1. the list of businesses registered to be contacted when the PWB switches from Bull Run water to well water and
2. businesses taking part in the PWB's commercial water conservation and efficiency efforts.

From these contact lists, we called representatives of grocery stores, hotels, food processors (including breweries, dairies, and processed food manufacturers), and hospitals. We received few returned phone calls after multiple attempts at contact via both telephone and email.

To reach the interviewees, it typically involved three to four phone calls to a particular company to identify and connect with a representative who had knowledge of what would occur during a BWN. Many attempted phone calls ended with a representative who was unwilling to answer questions or who had no useful information to answer our questions. We successfully completed interviews with representatives in the grocery and food processing sectors. These interviews confirmed the results of the interviews conducted in 2010 and were consistent with the results from the literature.

Other Representatives

In addition to industry representatives, we reached out to the Director of Portland's Bureau of Emergency Management, Carmen Merlo to understand the City's protocol for responding to an extended BWN, or other prolonged water service disruption. We also contacted representatives

⁶ Fryrear, A. 2015. "3 Ways to Improve Your Survey Response Rates." *SurveyGizmo.com*. Retrieved September 28, 2017, from <https://www.surveymzmo.com/survey-blog/survey-response-rates/>

⁷ Chyzheuskaya et al. 2017. "Economic Assessment of Waterborne Outbreak of Cryptosporidiosis." *Emerging Infectious Diseases*. 23(10): 1650-1656.

in Corpus Christi, Texas, which is one of the few jurisdictions that has experienced an extended BWN lasting almost two weeks. Finally, we reached out to Professor Colleen Heflin of the University of Missouri, who has conducted extensive research on the economic effects of water service disruptions. These interviews provided context and verified our findings from the literature review with regard to how businesses might respond to an extended BWN.

Input-Output Modeling

ECONorthwest built an input-output economic model of the study area using the IMPLAN modeling system. IMPLAN (for IMPact Analysis for PLANning) is generally regarded as the most reliable input-output modeling platform available, and is used by over 1,500 public and private clients. ECONorthwest has used this modeling system for well over 20 years.

Modeling Assumptions

Given the structure of the economy in the study area, the economic effects of the boil water notice depend on the following: 1) the timing and duration of the boil water notice; 2) the effects the boil water notice had on business operations and/or sales as determined by changes in hours of operation, changes in patronage, or other remedial actions taken by the directly affected businesses; and 3) the supply-chain relationships between directly affected businesses and their suppliers.

IMPLAN traces the initial changes in spending or output (a function of items 1 and 2 above) through the supply-chain relationships in study area (item 3 above). Thus, the primary input for IMPLAN is the initial change in output within the study area, based on information we collected from businesses, tailored to each BWN scenario.

Scenarios

We modeled economic effects with the study area for two scenarios:

1. A BWN lasting 48 hours or two days.
2. A BWN lasting for two weeks.

Model Inputs

Based on our research findings described below, we were able to identify with confidence that the food service sector likely would experience considerable negative effects on output related to closure and curtailment of service, under both the two-day and two-week BWN scenarios. This is the only effect we modeled in IMPLAN.

All other effects on spending patterns and industry output identified through our research were not modeled for several reasons:

- They were minor compared to total spending or output. For example, a hotel may purchase additional bottled water for customers. This spending is minor compared to overall output, and would actually reflect as a positive effect on the local economy.

- They represented a shift in spending in type or time, which would not result in a net effect on the economy in the study area. For example, households may spend more on prepared food, but less on other items in their grocery budget. A brewery might delay production during the BWN, but make up production after.
- They were difficult to measure, given available data. It is possible that households may shift some spending (e.g., on fresh produce from grocery stores) outside of the study area, which would represent a loss of output in the study area. These behavior changes are most likely to occur in the two-week scenario, and the implications of this omission are discussed in the results section.

Inputs for Two-Day Scenario

To estimate the effects on output from the two-day scenario, we used data from our survey that indicated the amount by which restaurants experienced changes in sales, for full-service establishments and limited-service establishments. For those establishments that closed, we assumed a 100 percent loss in sales. We multiplied these changes in sales by the average daily output for full-service and limited-service establishments, which we calculated from the output data provided in the IMPLAN model itself.

Table 3. Average Daily Effect to Full-Service Restaurants (Two-Day Scenario)

| Survey Response to BWN Effect | Percent of Establishments | Number of Establishments | Assumed Percent Change in Sales | Change in Output per Day |
|-------------------------------|---------------------------|--------------------------|---------------------------------|--------------------------|
| Closed-Lost All Sales | 22% | 228 | (100%) | (\$559,989) |
| Sales Decreased a Little | 25% | 260 | (5%) | (\$31,999) |
| Sales Decreased a Lot | 34% | 357 | (10%) | (\$87,998) |
| Sales Increased a Little | 3% | 32 | 5% | \$3,999 |
| Sales Stayed the Same | 9% | 97 | 0% | \$0 |
| Don't Know | 6% | 65 | 0% | \$0 |
| Total | 100% | 1,039 | | (\$675,987) |

Table 4. Average Daily Effect to Limited-Service Restaurants (Two-Day Scenario)

| Survey Response to BWN Effect | Percent of Establishments | Number of Establishments | Assumed Percent Change in Sales | Change in Output per Day |
|-------------------------------|---------------------------|--------------------------|---------------------------------|--------------------------|
| Closed-Lost All Sales | 33% | 192 | (100%) | (\$873,217) |
| Sales Decreased a Little | 20% | 115 | (5%) | (\$26,196) |
| Sales Decreased a Lot | 20% | 115 | (10%) | (\$52,393) |
| Sales Increased a Little | 7% | 38 | 5% | \$8,732 |
| Sales Stayed the Same | 0% | 0 | 0% | \$0 |
| Don't Know | 20% | 115 | 0% | \$0 |
| Total | 100% | 576 | | (\$943,075) |

This change in output was then entered into the IMPLAN model as a change in industry spending for each of the two respective restaurant industries. We multiplied this by two to account for the two-day scenario.

Inputs for Two-Week Scenario

To estimate the effects on output from an extended BWN, we used a different approach, which respects the considerably higher degree of uncertainty inherent in this scenario. We relied on the survey respondents' assessment of how their business would likely respond to an extended BWN. We focused only on the percent of establishments that predicted they would close for the duration. We then multiplied this percent by the average daily output for each category of establishment, and multiplied by 14 days to account for a full two-week BWN. We discuss the sources of uncertainty and our rationale for this approach below under results.

Table 5. Average Daily Effect to Full and Limited-Service Restaurants (Two-Week Scenario)

| | Percent of Establishments that Would Close | Number of Establishments | Average Daily Output | Change in Output per Day |
|-----------------|--|--------------------------|----------------------|--------------------------|
| Limited Service | 46% | 265 | \$4,548 | \$(1,205,040) |
| Full Service | 33% | 343 | \$2,464 | \$(844,783) |
| Total | | | | \$(2,049,824) |

Results

This section presents the results and conclusions of our analysis, synthesized from the literature review, survey, key-informant interviews, and IMPLAN modeling. We present the results of the online survey of food-service establishments first. We then describe the potential costs faced by four categories of potentially-affected sectors:

- Households
- Accommodation Businesses
- Other Business Sectors
- Food Service Businesses

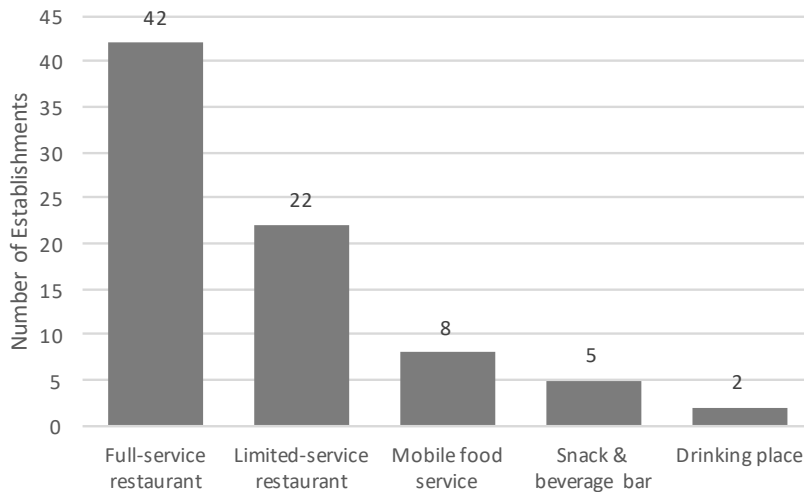
We then present the results of the economic analysis for the two-day and two-week BWN. We conclude with a summary and discuss the implications of the analysis.

Food-Service Establishment Survey Results

There were 79 respondents in total to the phone and email survey with over 75 percent of respondents coming from the full-service (53 percent) and limited-service (28 percent) restaurant industries. Figure 3 shows the break-down of survey respondents by type of establishment. Since fewer than 10 restaurants owners from Drinking places, Snack and

nonalcoholic beverage bars, and Mobile food services responded to the survey, the analysis focused on the effects to full-service and limited-service restaurants.

Figure 3. Number of Survey Respondents by Eating or Drinking Establishment Type

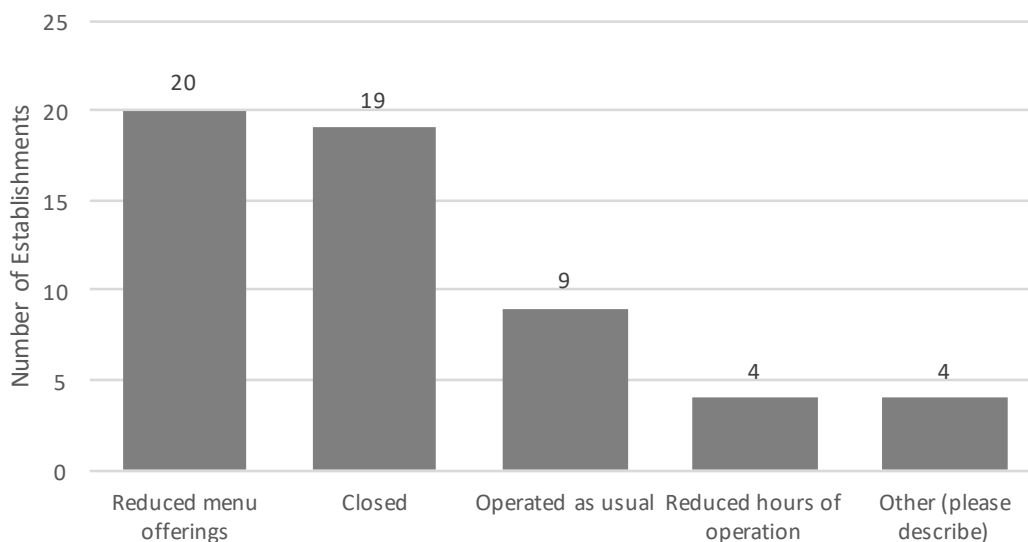


Source: ECONorthwest survey data

Response to 2014 BWN

The first part of the survey focused on business' actual responses to the BWN issued in May of 2014. As Figure 4 shows, over 75 percent either closed, reduced menu offerings, or reduced hours of operations. A minority operated as usual. Establishments in the "Other" category reported that they operated as usual with increased costs.

Figure 4. How Business Owners Responded to May 2014 BWN



Source: ECONorthwest survey data

After asking how businesses responded to the BWN, the following questions asked how the notice affected their business with respect to costs, revenue, and labor hours. Table 6 shows the average additional costs restaurant owners were faced with by category. There were only four respondents who listed “Other” costs, and the large average cost is due to one respondent listing “Lost revenue, \$5000”, an outlier.

Table 6. Average Costs Incurred by Eating and Drinking Establishments During May 2014 BWN

| Type of Cost | Average Cost Business Faced | Number of Responses to Question |
|---|-----------------------------|---------------------------------|
| Bottled Water or Ice Purchases | \$537 | 24 |
| Discarded Food | \$538 | 24 |
| Labor for Disinfecting or Food Prep | \$457 | 27 |
| Disposable Plates, Cups, Utensils, etc. | \$306 | 15 |
| Other (Please Describe) | \$1,375 | 4 |

Source: ECONorthwest survey data.

In addition to many businesses reporting that they faced added operating costs during the water boil notice, they also reported a change in revenue for that period. Table 7 shows the responses to survey question 4, which asks: *How do you think the boil water notice affected sales at your business?* 75% of respondents said that their business had a reduction in sales due to the water boil notice. Interpreting the results of the previous two questions, it is likely that most businesses saw less profit with costs increasing and sales falling over the disruption period.

Table 7. How did the 2014 BWN Affect Sales at your Business?

| Type of Cost | Percent of Respondents | Count of Respondents |
|---------------------------------------|------------------------|----------------------|
| Don't know | 11% | 7 |
| Lost all sales because we closed | 26% | 16 |
| Sales decreased a little (0-10%) | 21% | 13 |
| Sales decreased a lot (more than 10%) | 28% | 17 |
| Sales increased a little (0-10%) | 2% | 1 |
| Sales increased a lot (more than 10%) | 2% | 1 |
| Sales stayed the same | 10% | 6 |

Source: ECONorthwest survey data.

In addition to changes in sales, and operating costs, the survey also asked business owners how the water boil notice affected working hours for their employees. Table 8 shows the results to this question.

Table 8. How did the boil water notice affect employee work hours?

| Response | Percentage of respondents | Count of Respondents |
|--------------------------------------|---------------------------|----------------------|
| Closed – cut all employee work hours | 23% | 14 |
| Cut work hours a little | 10% | 6 |
| Cut work hours by 25% | 5% | 3 |
| Cut work hours in half | 16% | 10 |
| Don't know | 8% | 5 |
| Increased work hours | 16% | 10 |
| No change to work hours | 21% | 13 |

Source: ECONorthwest survey data.

While around half of respondents reported cutting working hours (the preponderance of responses was that the business owner closed during the notice), it is interesting to see that 16 percent of responders said that they increased work hours during the water boil notice. Write-in responses for some businesses indicated that in some restaurants the additional working hours were needed for food prep and to disinfect some equipment. This is reinforced by answers regarding the additional costs restaurant owners listed in Table 6.

Response to Hypothetical Extended BWN

After asking restaurant owners to reflect on their response to the previous water boil notice the survey then asked how restaurant owners would likely react in the event of an extended water boil notice, a disruption lasting a week or more. Asking restaurant owners to forecast their response to potential future event is a challenging question, and it is likely that restaurant owners are unable to fully account for all of the effects an extended water boil notice would bring since a disruption of this magnitude is unprecedented in this region. Nevertheless, it is interesting to see how the responses to this survey question differ to from the responses to Question 2.

Table 9. What would you do with your business if the boil water notice extended for a week or more, compared to a day or two?

| Response | Percentage of respondents | Count of Respondents |
|---|---------------------------|----------------------|
| More likely to invest in on-site disinfection equipment | 4% | 2 |
| More likely to operate with a reduced schedule | 9% | 5 |
| More likely to remain open with limited food service | 38% | 21 |
| More likely to temporarily close business | 38% | 21 |
| Other (please describe) | 11% | 6 |

Source: ECONorthwest survey data.

From the survey response, shown in Table 9, it seems that business would be more likely to close in the event of an extended water boil notice. It is also worth noting that only two respondents listed investing in on-site disinfection equipment as their likely response. Six

respondents listed other, and from reviewing those responses it seems that many of the businesses would remain open with some form of limited service or reduced schedule.

Analysis of Costs

Household Costs and Effects

The results of the literature review suggest that households face several types of costs when a BWN is issued. Heflin et al. (2014)⁸ conducted the most extensive research to date on costs incurred during BWN. They surveyed residents in four communities that experienced BWN lasting between 2 and 10 days. They report costs in four categories: direct water consumption (bottled water, disinfection, and replacing filters), cooking and eating (disposable dishware, eating out more or less), work and school schedule disruptions (changes in work schedules and childcare requirements), and travel costs (travel for supplies and cost for lodging when staying outside the area). Total household costs per event, for urban residents, was \$65.⁹

Across all households surveyed, 78 percent reported using more bottled water than usual, though many households reported that they already regularly purchased bottled water. About 20 percent of households reported that someone in the household continued to drink tap water during the BWN. This lack of compliance is reported elsewhere in the literature as well.¹⁰ Over half of households reported shifting their cooking techniques to methods that did not require water, such as grilling or microwaving prepared food. Just under half of households reported buying disposable tableware. Interestingly, during BWN about 40 percent of households ate out at a restaurant “more than usual.” Only 9 percent of households reported eating out “less than usual.”

Assuming the average cost per event reported by Heflin et al. is consistent with the way households in the study area would respond during a two-day BWN (and there is no evidence to suggest otherwise), the costs incurred would total about \$20 million. Because they report costs for households by event, not per household per day, it is speculative to scale these costs to a two-week BWN. If we assume that household behavior remains consistent over the two-week period, however, the costs could reach around \$91 million during a two-week BWN. It is important to note the uncertainty around this estimate, given the limitations associated with the study.

These costs represent economic effects to households in the study area. As we describe in our methodology section above, they do not necessarily translate to economic effects, in terms of changes in output, jobs, or other indicators of economic activity. Households typically spend

⁸ Heflin, C.M., J.K. Jensen, and K.K. Miller. 2014. “Understanding the Economic Impacts of Disruptions in Water Service.” *Evaluation and Program Planning*. October.

⁹ Costs converted from 2012 dollars to 2014 dollars using the CPI.

¹⁰ Ailes, E., et al. 2013. “Economic and Health Impacts Associated with a *Salmonella typhimurium* drinking water outbreak, Alamosa, CO, 2008.” *PLOS One*, 8(3).; Harding, A.K., and E.C. Anadu. 2000. “Consumer Response to Public Notification.” *AWWA Journal*, 92(8): 32-41.

within a budget. Thus, increased purchases of bottled water may be offset by fewer other grocery items or other goods or services the household typically consumes. A household may spend more during a BWN, but less in the weeks after the BWN, to maintain their monthly budget.

Some of the increases reported in the Heflin et. al survey relates to travel costs to leave the study area and stay elsewhere. This is a clear case where household spending patterns may result in economic effects: instead of usual spending in the study area (close to home), households would spend their money on hotels and restaurants outside the study area. This would represent a loss of spending in the study area, and likely reduce overall output of businesses in the study area.

Of the households surveyed, about 20 percent left at some point during the BWN to stay somewhere else for at least one night. This response is more likely to occur when a BWN occurs over a weekend, when people are more flexible to leave, or when it extends for a longer duration (such as the two-week scenario). Similarly, when households leave the study area to purchase supplies, such as groceries, outside the study area when they normally would have purchased them locally, this would also result in a loss of spending in the study area. Thus, it is likely that economic effects arising from households spending would be larger and more likely to occur during the two-week scenario. Data are unavailable to reliably estimate this effect, however.

Accommodation Sector Costs and Effects

A BWN would have several effects on accommodation sector of the economy, largely spurring from how the tourism industry would respond. As evidence from Portland and elsewhere indicates, a two-day BWN is unlikely to scare tourists away from the City. For Portland, with good emergency planning, the tourism industry can handle a two-day boil water advisory and while visitors on that day will spread the negative news back home,¹¹ they represent only about one-percent of annual tourists to Portland. It is unlikely to have much effect.

Thus, during this scenario, the primary costs to the accommodation sector associated with the BWN are increased costs of bottled water, and potential increased labor for posting signage, disinfecting ice machines, and running tap water after the event. These costs are relatively small compared to total revenue generated from room charges, and would reflect in an economic impact analysis as spending in the retail sector from bottled water purchases. Labor income may increase, if overtime is paid to employees responsible for the mop-up. We do not include these potential effects in the two-day IMPLAN modeling presented below.

A two-week BWN could be quite different. Likely to be prominent in national and world news reports because the event spans several news cycles, directly affecting about 345,000 tourists

¹¹ Larino, J. "Here's how New Orleans hotels, restaurants are handling the boil water advisory." New Orleans Business Journal. September 20, 2017.

(over 400,000 in the summer peak season), and give time for last minute deciders to pick a different destination, it would have immediate negative effects. In the summer, Portland hotels sell about 115,000 room nights every two weeks, bringing in \$22 million in room revenues alone. Most of that, at that time of year, comes from discretionary leisure travelers who could easily choose another city to visit or simply drive elsewhere in Oregon where there is not boil water notice.

A recent study of a 2007 water-borne disease outbreak in Galway, Ireland and surrounding areas (which required a boil water notice that lasted for 158 days) found that hotels, bed and breakfasts, and hostels experienced a 13 percent room cancellation rate. Galway is an extreme case, and likely represents the upper bound of what Portland could experience. In contrast, however, Corpus Christi recently experienced a BWN that lasted about two weeks (12 days), and occurred just prior to the Memorial Day weekend. City officials expected the worst, but those fears did not pan out:

It was a nuisance a bit, but it didn't prohibit people from coming and doing the work they needed to do in Corpus Christi. And the Beach to Bay weekend was great," said Paulette Kluge, the CEO of the Corpus Christi Convention and Visitors Bureau. "Our industry did a great job adapting to this and minimizing the impacts on visitors. I personally don't think there's going to be any long-term effects¹².

Should an effect such as what was experienced in Galway occur in Portland, room revenues could decline by about \$2.8 million, assuming the BWN occurred during the summer. It is possible that in response to a sudden decline in tourists, lodging establishments would reduce room rates to entice people to come to Portland despite the BWN. Should this occur, revenues could decline further, or tourists would positively respond and choose to come to Portland, offsetting some (but not all) of the reduced revenues. Room tax collections would respond commensurately. In contrast, if Portland's experience is similar to that in Corpus Christi, effects to the accommodation sector could be minimal. We do not include these potential economic effects in our IMPLAN modeling presented below because uncertainty about the effect is too great.

Other Business Sector Costs and Effects

Grocery Stores

The sectors most likely to face costs apart from food service and accommodation are grocery stores (in the retail sector) and food processors (in the manufacturing sector). Grocery stores certainly have highly visible costs, subsequent to issuing a BWN. Any potentially contaminated food must be discarded. This includes deli prepared food and fresh produce. Staff must

¹² Woolbright, M. 2016. "Economic Experts: Boil Water Notice Mostly 'Inconvenience'" *Corpus Christi Caller-Times*. May 28. Retrieved September 28, 2017, from <http://archive.caller.com/news/energy-effects/water/economic-experts-boil-water-notice-mostly-inconvenience-33c7cac5-5575-6894-e053-0100007fdfee-381156821.html>

disinfect surfaces and equipment that was in contact with tap water, leading to higher labor costs.

In our interview with one Portland-area grocer, all of these costs occurred during the May 2014 BWN. However, this grocer also reported that sales increased for certain items, such as bottled beverages. Data are limited about the costs to grocery stores resulting from BWN, but Heflin et al., indicate that consumers increased spending on prepared foods, bottled beverages, and disposable tableware. Anecdotal evidence from that study also suggested that lines were long at grocery stores because of the rush to purchase supplies. Thus, the net effect on grocery store revenues during the two-day and two-week scenarios is unclear.

When addressing how circumstances would differ with a two-week BWN, the concern from the grocer we interviewed was that customer spending would decline steadily over the period and would not make up for the extra labor (by salaried employees), risk, and hassle that would occur, management would have to weigh closing for the duration. Should this occur, revenues would decline and may not be offset with increased demand once the BWN was lifted and the store reopened.¹³

Food Processors

Food processors, including breweries, dairies, and food manufacturers, rely in various ways and to varying degrees on untreated tap water. From our interviews, each business has its own protocols for responding to a BWN, and are vulnerable in different ways. Thus, it is impossible to generalize effects for this sector, and costs and economic effects may only be estimated from a large-scale survey that includes most businesses.

Based on information we were able to gather, breweries were largely unaffected by the 2014 BWN, and likely would experience minimal effects from a future two-day BWN. This is because they rely in limited ways on untreated tap water (water is boiled anyway to produce beer, so generally only used for cleaning and filtering). Most facilities can delay certain aspects of their brewing process to avoid using untreated water during the BWN.¹⁴ A two-week BWN may be more of an inconvenience because delays may not be possible for that length of time, but specific costs are not readily quantifiable.

Information available from the literature suggests that a BWN lasting for an extended duration could have an adverse effect on some food manufacturers. In 2013, Baker City, Oregon issued a BWN that lasted for more than two weeks, resulting from detection of *Cryptosporidium*. Baker City is home to Tasty Bake, a manufacturer of ready-to-bake pizza dough. The plant, which had been advertising to hire workers, put out a statement that in response to the BWN, they

¹³ Personal communication with manager at Food Front Co-Op.

¹⁴ Personal communication with Chris Guy, QA Manager at Bridgeport Brewing.

experienced lost business, which resulted in staff layoffs.¹⁵ In contrast, Barley Brown's, a brewery located in Baker City, experienced no direct adverse effects of the BWN. The greatest impact on the brewery resulted from customers in Portland who were concerned that the product was not safe. The brewery fielded multiple inquiries, and potentially lost sales in distant and unaffected markets, from the perception of potential contamination.¹⁶

It is possible that similar temporary layoffs could occur if production at any number of Portland's food manufacturers halts during the BWN. It is also possible that once the BWN is lifted, facilities may ramp up production to fill orders placed during the BWN, leading to offsets in earned revenue and hours worked. Thus, the effects of a two-week BWN are impossible to estimate given available data.

Food Service Costs and Effects

Our survey of food-service establishments suggests that while effects are mixed across individual businesses (with some experiencing increased sales), the overall effect of the BWN is to increase costs and reduce revenues. Based on combining our survey results with baseline data on the food-service sector from IMPLAN, the food service sector may experience reductions in output of \$1.6 million per day, arising primarily from full service and limited service restaurant closures.

A minority of restaurants closed in response to the 2014 BWN, though the share was not insignificant at around 30 percent, and a larger proportion (though still a minority at between 33 and 46 percent depending on restaurant type) predicted they would close in response to a BWN lasting for two weeks or longer.

We used the IMPLAN model to estimate the economic effects on the economy from this reduction in revenue. This reduction in revenue represents the industry's gross change in output. We used this input in the IMPLAN model to represent a change in industry spending for each of the two respective restaurant industries. The model then calculates the direct effects and indirect effects arising from reduction in revenue in the two restaurant sectors, producing an estimate for the total effects to the regional economy.

Indirect effects occur as directly affected businesses reduce their "supply-chain" purchases. For example, a closed restaurant will temporarily reduce its purchases of fruit, vegetables, and meats. Given that most of these goods are imported into the study area, this second round of foregone sales (in this example) will affect local wholesalers and transporters. The analysis reports the following economic effects.

¹⁵ Associated Press. 2013. "Baker City Plant Cuts Workers After Cryptosporidium Outbreak." *Mail Tribune*. August 20.

¹⁶ ECONorthwest spoke with Barley Brown's Beer on October 12, 2017. The manager confirmed that they did not experience costs or production resulting from the BWN in 2013. He noted that the majority of the negative economic impact in the town was due to reduced tourism to the area, based on long-term concern about the contamination of the water. Personal communication with Tyler Brown, Manager, Barley Brown's.

- **Output** or changes in sales, represents the total gross value of goods and services produced in the defined study region. This was calculated using the IMPLAN model and the telephone and Internet surveys.
- **Gross Regional Product (GRP)**, which represents the value added by households, businesses, and governments in the study area. Changes in output, as measured in our surveys, will translate into changes in incomes/taxes for entities involved in the production process. These changes in GRP are estimated by our economic model and include the following components:
- **Wages**, excluding benefits. Closure or reduced hours of operation will affect the wages received by hourly workers, and most workers in the affected sectors are hourly workers. Because the boil water notice is temporary, it is assumed to not alter the benefit packages received by workers.

IMPLAN calculates two other inputs that, in our judgement, are unlikely materially affect the economy under the two-day BWN scenario:

- **Jobs.** In our judgment, hours of work may be affected but it is unlikely that employees would be laid off or hired as a result of a two-day BWN. Rather, they are likely to see and increase or decrease in hours worked during the notice.
- **Induced effects** associated with changes in household incomes. In our judgment, the changes in economic activity attributed to the two-day BWN are so temporary in nature that changes in wages and income are unlikely to alter consumer spending patterns.

Direct and Indirect effects are shown for the two-day scenario in Table 10. Estimated Quantifiable Economic Effects of a Two-Day Boil Water Notice. These results suggest that a two-day BWN would result in about \$2.8 million in foregone sales to restaurants. These foregone sales (or revenue) would result in less spending in the supply chain (suppliers to the directly affected businesses). The direct loss in sales translates into a \$1.6 million loss in GRP, including and estimated \$1 million loss in wages. These direct changes will cause sales at indirectly affected businesses to fall by a little more than \$830,000, and this includes a reduction of over \$268,000 in wages.

Table 10. Estimated Quantifiable Economic Effects of a Two-Day Boil Water Notice

| Effect Type | Output | GRP | Wages |
|-----------------|---------------|---------------|---------------|
| Direct Effect | \$(2,838,863) | \$(1,592,678) | \$(1,089,905) |
| Indirect Effect | \$(830,167) | \$(472,285) | \$(268,839) |
| Total Effect | \$(3,669,030) | \$(2,064,963) | \$(1,358,743) |

Source: ECONorthwest IMPLAN Analysis, with data from IMPLAN and the Food Service Sector Survey

The two-week scenario is based on revenue lost by limited-service and full-service restaurant closures as predicted by business owners in our survey. While other businesses may lose revenue from limiting hours or reducing menu offerings, these changes are too speculative to

quantify over the two-week period. The estimated economic effects from this reduction in revenue are shown in Table 11.

These results suggest that a two-week BWN would result in about \$25 million in foregone sales to restaurants. These foregone sales (or revenue) would result in less spending in the supply chain (suppliers to the directly affected businesses). The direct loss in sales translates into a \$14 million loss in GRP, including and estimated \$9.6 million loss in wages. These direct changes will cause sales at indirectly affected businesses to fall by a little more than \$7.3 million, and this includes a reduction of almost \$2.4 million in wages.

In contrast to the two-day BWN, where, in our judgement, effects on wages and jobs are unlikely to result in altered spending patterns, a two-week BWN may disrupt households enough to induce such changes. For this reason, we include these induced effects in the two-week analysis. Total economic effects, including direct, indirect, and induced effects on output would amount to almost \$40 million over the two-week period.

Table 11. Estimated Quantifiable Economic Effects of a Two-Week Boil Water Notice

| Effect Type | Output | GRP | Wages |
|-----------------|----------------|----------------|----------------|
| Direct Effect | \$(25,159,130) | \$(14,116,588) | \$(9,615,999) |
| Indirect Effect | \$(7,357,187) | \$(4,185,346) | \$(2,381,692) |
| Induced Effect | \$(6,376,733) | \$(3,800,817) | \$(2,296,770) |
| Total Effect | \$(38,893,051) | \$(22,102,751) | \$(14,294,460) |

Source: ECONorthwest IMPLAN Analysis, with data from IMPLAN and the Food Service Sector Survey

Summary of Costs and Economic Effects

In our analysis, we describe the costs that households and businesses could experience under a BWN. Some of these costs could lead to positive economic effects by increasing spending for some sectors (e.g., increased purchases of bottled water), and negative economic effects by reducing spending in other sectors (e.g., reduced purchases of fresh produce). Much of this change in household and business spending is likely to simply *transfer* spending from one sector of the economy to another, and not result in net negative economic effects within the study area. However, some costs or perceived costs to businesses (e.g., increased labor to boil water in a restaurant, or reduced customer spending) may result in reduced productivity or temporary closure that would likely not be offset entirely.

Ideally, an analysis of economic effects of a BWN would account for all increases and decreases in economic activity within the study area over the duration of a BWN. The consumer and business responses to a BWN, however, are complex. They are also likely to vary considerably between a two-day and two-week BWN event, as households and businesses adapt to changing conditions or encounter threshold effects that induce different responses over time. Further complicating this analysis is the fact that the BWN would occur within a study area that spans only part of the Portland Metropolitan region. This affords people the opportunity to change

their spending patterns geographically, as well as categorically. For example, it may be easy for someone on the east side of Portland to shop or eat in Gresham, where water service remains unaffected.

Our analysis does not take into account these dynamic relationships. The estimates of economic effect reported in this analysis show a snapshot of the consequences arising from lost spending at a portion of restaurants in the study area that would close when faced with a BWN (and in the case of the two-day scenario, reduce operations as well). Because we have been asked to model what might happen during a two-day and two-week BWN, rather than to measure and report ex-post during a BWN, our analysis embodies a great deal of uncertainty. Our analysis may overestimate the actual economic effects under both scenarios for these reasons:

- Businesses may have a **greater ability to adapt** than they anticipate, especially when faced with a two-week BWN. Estimated closure duration and revenue losses may be greater than actually materialize.
- **Shifts in consumer and business behavior** during and after the BWN may offset some of the estimated losses, should patrons increase their spending at restaurants affected by the BWN, in support of their long-term viability.

Conversely, our analysis may underestimate the actual economic effects under both scenarios, but particularly under the two-week scenario, for these reasons:

- We include only one category of effect in our IMPLAN analysis, though we identified other areas where economic effects may occur but are too speculative to quantify given available data. The largest of these is likely reduced spending arising from **reduced tourism**, should people choose to cancel trips to Portland during the BWN. These effects are unlikely to materialize in the two-day scenario, but are more likely under a two-week scenario, particularly if the event is not well managed, businesses are not prepared, and the BWN is accompanied by actual cases of illness.
- We did not attempt to model **shifts in household spending** that transfer outside the study area. For example, a household travels to Gresham or Beaverton to purchase groceries instead of going to their usual Portland grocery store. Similarly, some households may schedule overnight trips to escape the inconvenience of the BWN, shifting some of their spending outside of the region when they may have stayed home instead without the BWN. These effects are unlikely to occur under the two-day scenario, but may be more likely to arise after two weeks.
- We focus the economic effect modeling on the food service sector, for which we were able to obtain relatively robust data that indicated revenues would likely decline within the economic study area. It is possible that **other business sectors**, especially grocery stores and some food processors, may experience revenue losses that they would not be able to recover after the BWN ends.

Appendix A: Survey Instrument

Email Introduction (Initial Wave)

ECONorthwest and the City of Portland are doing a study of the economic impacts of disruptions in water service, such as when the City issues a boiled-water notice. Your experience as an owner or manager of a local business will help us to better measure and describe these impacts. Please consider participating in a short online survey: it should only take about 5 minutes to complete. All of the responses will be kept confidential.

Take the survey [[link to online survey](#)].

If you have any questions about this survey or the economic impact study, please contact Sarah Reich at reich@econw.com or 503-222-5083.

Thank you for taking part in this important effort!

Email Introduction (Second Wave)

The Portland Water Bureau has partnered with ECONorthwest Consulting to conduct a study on the economic impacts of disruptions in water service, in particular, this survey relates to boil water notices.

A boil water notice is issued when the City detects contamination, or potential contamination, of the drinking water supply. During a boil water notice, the City recommends that customers boil all tap water used for drinking, food preparation, and ice making for at least one minute. Furthermore, the City recommends that customers discard items that were prepared with un-boiled tap water for a period before the boil water notice was issued. A boil water notice lasts until the contamination issue is resolved. They are usually short, but in worst case scenarios can last for a few weeks.

Please take ten minutes to complete this important survey on water service disruptions and their impact on local Portland restaurants by Aug. 30. This survey will help the Portland Water Bureau to understand the effect that a boil water notice will have on your business.

Link to the survey: <https://www.surveymonkey.com/r/waterpdx>

Any questions, concerns, and comments you have related to the survey can be directed to Marley Buchman at buchman@econw.com, or Sarah Reich at reich@econw.com.

Thank you for your time.

Survey Questions (Online Survey)

Thank you for agreeing to take part in this survey. The City of Portland wants to better understand the economic impacts to businesses of disruptions in water service, such as boiled-water notices. The City issues a boiled-water notice when it detects contamination in the drinking water supply. Here [link: <https://www.portlandoregon.gov/fish/article/491686?>] is an example of a boiled-water notice. During a boiled-water notice, the City recommends customers boil all tap water used for drinking, food preparation, and ice for at least one minute, and discard items prepared with un-boiled tap water for a period before the boiled-water notice is issued.

We'd like your feedback on the following questions, to better understand how restaurants, bars, and similar businesses would respond during a boiled-water notice that lasts for a short time (e.g., 2 days) and for a longer period (e.g., 2 weeks).

1. If you own or run a restaurant, bar, or similar business in Portland, which category best describes your business?

[Full-service restaurant/Limited-service restaurant/Snack and nonalcoholic beverage bar (e.g., coffee shop)/Drinking place (alcoholic beverages)/Mobile food service/Don't own or run a business in Portland]

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In May 2014, the City of Portland issued a boiled-water notice that lasted around 24 hours. The following questions apply to that event.

2. If you ran your business at that time, what did you do?

[Operated as usual/Reduced menu offerings but otherwise operated as usual/Reduced hours of operation/Closed/Didn't run my business then/Other-Please Describe]

[If they answered any way other than "Didn't run my business then" go to question 3.]

3. How do you think the boiled-water notice affected sales at your business?

[Sales increased a little (0-10%)/Sales increased a lot (more than 10%)/Sales stayed the same/Sales decreased a little (0-10%)/Sales decreased a lot (more than 10%)/Lost all sales because we closed]

4. Did your business experience any of the following costs because of the boiled-water notice? If so, indicate the approximate cost.

[Bottled water or ice purchases/Discarded food/Labor for disinfection or food preparation/Disposable plates, cups, and utensils/Other-Please describe]

5. How did the boiled-water notice affect employee work hours?

[Closed-cut all employee work hours/Cut work hours in half/Cut work hours by 25%/Cut work hours a little/No change to work hours/Increase work hours]

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6. What would you do with your business if the boiled-water notice extended for a week or more, compared to a day or two?

[More likely to temporarily close business/More likely to remain open with limited food service/More likely to operate with a reduced schedule/More likely to invest in on-site disinfection equipment/Other-Please describe]

7. What additional costs might your business face if the boiled-water notice extended for a week or more?

[Please describe]

8. Is there anything else you would like us to know?

[Text box for responses.]

Appendix B: Survey Responses

1. If you own or run a restaurant, bar, or similar business in Portland, which category best describes your business?

| Response | Count | Percentage |
|--|-------|------------|
| Full-service restaurant | 42 | 53% |
| Limited-service restaurant | 22 | 28% |
| Mobile food service | 8 | 10% |
| Snack and non-alcoholic beverage bar (e.g., coffee shop) | 5 | 6% |
| Drinking place (alcoholic beverages) | 2 | 3% |
| Don't own or run this type of business in Portland | 0 | 0% |
| Total | 79 | 100% |

2. If you ran your business at the time of the boil water notice, what did you do?

| Response | Count | Percentage |
|---|-------|------------|
| Reduced menu offerings but otherwise operated as usual | 2 | 33% |
| Closed | 9 | 31% |
| Operated as usual | 9 | 15% |
| Other (please describe) | 5 | 8% |
| Reduced hours of operation | 4 | 7% |
| Didn't run my business then (please respond to the rest of the questions based on your best guess of how you would respond now) | 4 | 7% |
| Total | 6 | 100% |

3. Did your business experience any of the following costs because of the boil water notice? If so, indicate the approximate cost.

| Type of Cost | Average Cost, per business | Count |
|---|----------------------------|-------|
| Labor for Disinfecting or Food Prep | \$457 | 27 |
| Bottled Water or Ice Purchases | \$537 | 24 |
| Discarded Food | \$539 | 24 |
| Disposable Plates, Cups, Utensils, etc. | \$306 | 15 |
| Other (Please Describe) | \$1,375 | 4 |
| Total | \$513 | 94 |

4. How do you think the boil water notice affected sales at your business?

| Response | Count | Percentage |
|---------------------------------------|-------|------------|
| Sales decreased a lot (more than 10%) | 17 | 28% |
| Lost all sales because we closed | 16 | 26% |
| Sales decreased a little (0-10%) | 13 | 21% |
| Don't know | 7 | 11% |
| Sales stayed the same | 6 | 10% |
| Sales increased a little (0-10%) | 1 | 2% |
| Sales increased a lot (more than 10%) | 1 | 2% |
| Total | 61 | 100% |

5. How did the boil water notice affect employee work hours?

| Response | Count | Percentage |
|--------------------------------------|-------|------------|
| Closed – cut all employee work hours | 14 | 23% |
| No change to work hours | 13 | 21% |
| Cut work hours in half | 10 | 16% |
| Increased work hours | 10 | 16% |
| Cut work hours a little | 6 | 10% |
| Don't know | 5 | 8% |
| Cut work hours by 25% | 3 | 5% |
| Total | 61 | 100% |

6. What would you do with your business if the boil water notice extended for a week or more, compared to a day or two?

| Response | Count | Percentage |
|---|-------|------------|
| More likely to remain open with limited food service | 21 | 38% |
| More likely to temporarily close business | 21 | 38% |
| Other (please describe) | 6 | 11% |
| More likely to operate with a reduced schedule | 5 | 9% |
| More likely to invest in on-site disinfection equipment | 2 | 4% |
| Total | 55 | 100% |

7. What additional costs might your business face if the boil water notice extended for a week or more? Please describe.

| Responses |
|--|
| <ul style="list-style-type: none"> Loss of income |

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- Additional costs for sodas, juices, labor involved with additional procedures when boiling water.
 - Loss of production, would have to stop making Beer
 - Order a significant amount of bottled water for our operations.
 - There is no feasible way to boil water at my coffee shop (we do not have a kitchen facility). We use filtered water for the plumbed water line into the brewer and espresso machine, so that may address the contamination issue - or maybe not. However, without the ability to boil water we wouldn't be able to wash hands for food preparation, wash hands after bathroom, after touching money, or to avoid cross contamination between food allergens.
 - Utility costs and time cost for having to boil all water. Possibly equipment for boiled water storage.
 - We would need to purchase all water, ice, and soft drinks. We would not be able to serve ice tea or coffee. We would need to ensure our dish machine was properly sanitizing dishes. We would most likely see another decrease in sales which would result in employees losing hours.
 - It would become fairly impossible to remain open and running.
 - 5000 in labor cost and paper product
 - huge loss of revenue
 - Food could not be washed appropriately. Ice could not be made for drink service. There is a strong likelihood we would have to close for the duration of the warning
 - we would lose sales, product, potentially have to pay unemployment. it would be financially crippling.
 - Labor goes up, purchase disposables, food would spoil,
 - Labor costs greatly increased and having to spend more money on things that are generally very inexpensive, ice, soda and mixers for the bar.
 - Ice, potable water for disinfecting & cleaning.
 - I'm not sure what we would do about washing vegetables, probably a combination of boiling and cooling water and buying bottled water.
 - Additional labor in the kitchen and bar. Additional garbage. Additional recycling. Additional cost of buying ice, canned soft drinks, bottled water, etc.
 - Hard to calculate, but it would be very detrimental to the health of the business.
 - Additional staff hours, buying ice and water
 - Loss of revenue, loss of employees due to no available work, loss of getting customers to come back. It would be the shits for sure!
 - Possibly additional labor costs for employees to come in early to boil big pots of water. Having ice for cocktails was the biggest challenge.
 - It is devastating to us... cost of going out of business.
 - Not so much costs, but missed sales and lost wages for employees
 - The boil-water notices create a sense of panic for our customers and they tend to find alternative places to eat. Extended duration boil notices would heavily impact our business in a negative way.
 - We have start-up costs for disinfecting our soda system, our bun steamers, ice makers and cooking surfaces.
 - Increased cost on plastic and paper goods, increased labor due to changed work routines additional cost for sanitizing and cleaning
 - A week of boiled water notice would be devastating for a full-service restaurant. I would estimate a closure that would cost tens of thousands in gross, and thousands in NET profit. Needless to say, I'd consider it unacceptable.

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- Need to buy drinking water and Ice.
 - To go container cost would sky rocket, assuming we could even get the product?
 - loss of sales, loss of perishable food inventory
 - Could put us out of business-- very expensive
 - uncertain
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8. Is there anything else you would like us to know?

Response

- please don't let it happen again!
- Boiling water is not feasible in many small businesses that lack full kitchens. It could mean the end of operation if such a notice were to be in effect for more than a day or two.
- I am a hospital need to feed patients would boil water
- Its really hard to remember cost of something that happened over 3 years ago, perhaps you could ask a little sooner next time?
- Technically, a bar, restaurant, coffee shop, etc would need to be shuttered because if it remained open it would be in violation of health code re: running water.
- It'd be nice to get some assistance when that happens. Also, please please, please protect our water and water rights. Big companies will buy and tap it and charge us WAY TOO MUCH for way too little
- Every time we have a boil notice it is an huge trouble to get everything replaced and get water safe to drink for our guests.
- It would not be fun...and a prolonged outage would likely cost us tens of thousands in either increased operating costs or reduced business. PS. Do we get a break on sewer rates when we have contaminated water?
- I think that business owners' private cell phone numbers should be on the emergency list as well as the robo-call to restaurants. I know this is asking a lot, but sometimes, if the robo-call is made during business hours, during a very busy time, this might be the best way to get the message through to the right person. Getting the message to the right person is important, and perhaps more education on the most efficient and effective ways to deal with the problems, so no one gets sick.
- Please do not allow a long notice to happen. We have enough issues operating within the City of Portland (higher min wage, family leave, massive fees to do business) ---this would just drive even more of us to leave Portland proper and go to outlying counties/communities where they actually value small businesses
- We own a meat plant down the street and we would have to throw out all product that came in contact. It is a devastating loss.
- A full week of unsafe water would potentially put us out of business.
- It is a very complicated process to get back up and running. Please do everything possible to not have this happen. It is a nightmare.
- The city of Portland has shown complete disregard for small business in every other way, so it doesn't surprise me that they have to conduct an interview to understand the impact of no usable water to a full-service restaurant. In short, Portland, DON'T do whatever you're thinking about doing.
- Reduce rate during that week.

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- We take all precautions when something like this happens, but other restaurants do not. For example, serving soft drinks from a gun. There is no enforcement. Therefore, restaurants that choose to do the right thing and reduce offerings or close face unfair competition from restaurants who stay open and ignore notices. If we were all truly interested in safety, we would all be told to shut down equally. There are so many ways unboiled water can get into food supply and you trust thousands of owners and managers to identify and take correct action. Ludicrous to think that they would not either make mistakes from ignorance or from fear of lost income. I know for a fact that restaurants were making food from water out of their coffee makers thinking it was hot enough to kill bacteria yet it doesn't even reach boiling point. Willful ignorance from the city to think that so many people will be capable of keeping the public truly safe.
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